



## The *Campsicnemus lobatus* and *zigzag* groups in the Society Islands, French Polynesia (Diptera: Dolichopodidae)

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### Abstract

The genus *Campsicnemus* is recorded for the first time from the Society Islands in French Polynesia. Two endemic species groups are recognized: the *lobatus* group (5 new species) and the *zigzag* group (5 new species) and keys given to species within them. The following 10 new species are described and illustrated: *Campsicnemus borabora* Evenhuis, **n. sp.** (Bora Bora); *C. lobatus* Evenhuis, **n. sp.** (Moorea); *C. mylloseta* Evenhuis, **n. sp.** (Huahine); *C. ogradyi* Evenhuis, **n. sp.** (Tahiti); *C. ostlinx* Evenhuis, **n. sp.** (Raiatea); *C. paralobatus* Evenhuis, **n. sp.** (Tahiti); *C. rheocrenus* Evenhuis, **n. sp.** (Tahiti); *C. tahaanus* Evenhuis, **n. sp.** (Tahaa); *C. tunoa* Evenhuis, **n. sp.** (Moorea); and *C. zigzag* Evenhuis, **n. sp.** (Tahiti).

**Key words:** *Campsicnemus*, French Polynesia, taxonomy, species groups, Tahiti, Bora Bora, Moorea, Raiatea, Huahine

### Introduction

*Campsicnemus* Haliday is a widespread genus throughout the Northern Hemisphere with an incredible diversity of species in the Hawaiian Islands (see reviews of the genus in the Hawaiian Islands in Hardy & Kohn 1964; Tenorio 1969; and Evenhuis 2003). Few studies have been conducted on the genus in the Southern Hemisphere and, aside from only two species known from the subequatorial Africa [e.g., *Campsicnemus caffer* (Curran 1926) and *C. yangi* (Grichanov, 1998)], little is known of the faunal representation elsewhere in the Southern Hemisphere. Parent (1934) was the first to describe a water-skating *Campsicnemus* (*C. scurra*) from the Marquesas based on specimens collected by Evelyn Cheesman on the St. George Expedition. More than sixty-five years later, Evenhuis (2000) described two additional new species of water-skaters (*C. limnobates* and *C. uncleremus*) from other islands in the Marquesas based on material collected on surveys conducted from 1999–2001 by Bishop Museum and the Smithsonian Institution. These two species (and *C. scurra*) have subsequently been found to belong to a monophyletic species group only known from the Marquesas (this group is currently under review with results including an additional new species to be published elsewhere).

Recent surveys from 2004–2007 in the Society Islands by myself and others (partly under the auspices of a grant from the National Science Foundation) have discovered dozens of new species that are currently under revision. Among the new species discovered during this study, ten new species have been found from the Society Islands that fit into two monophyletic species groups (named here the *lobatus* and *zigzag* groups). These groups are keyed, defined, and discussed below and the new species within them described and illustrated.

## Materials and methods

Specimens studied in this study derive from material collected during the Terrestrial Arthropods of French Polynesia Survey funded by the U.S. National Science Foundation. This material resides in the Bishop Museum, Honolulu (BPBM). Holotypes and paratypes are deposited in BPBM. Where length of series allow, duplicate paratypes are deposited in the Essig Museum, University of California, Berkeley (EMEC). Specimens that have been databased as part of the French Polynesia Arthropod Survey have numbers in the format BPBMxxxxxxx and EMECxxxxxxx [with 6 or 7 digits]. These data are held in the Essig Museum, University of California, Berkeley (these numbers not to be confused with Bishop Museum type numbers in this paper that are in the series BPBM 16,xxx [with 5 digits]).

Morphological terminology and abbreviations follow Evenhuis (2003); antennal terminology follows Stuckenberg (1999).

## Systematics

My study of *Campsicnemus* in the Pacific has identified three species groups known only from French Polynesia: one (unnamed—to be named for a species to be described elsewhere as new) from the Marquesas that includes water skaters that were treated in Evenhuis (2000); the *lobatus* group (newly defined here, containing 5 new species known only from the Society Islands), and the *zigzag* group (newly defined here containing 5 new species known only from the Society Islands). Other species from French Polynesia are currently under study and, in comparison to other known *Campsicnemus* in the Pacific including the Hawaiian Islands, will be placed in other species groups. With the new species described here, there are now 13 species known from French Polynesia.

### Key to species groups of *Campsicnemus* in French Polynesia

1. Fore coxa with cluster of 3–4 black setae subapically on anterior surface (directed forward) that appear to be fused together forming thorn-like projection; mid basitarsus shortened, with apical spur of varying shapes; mid and hind tibia with extremely long hairs with wavy tips... (Marquesas)..... unnamed species group  
[Included species: *C. limnobates* Evenhuis; *C. scurra* Parent; *C. uncleremus* Evenhuis; one undescribed species]
- . Fore coxa without an modified cluster of setae; mid basitarsus without apical spur; mid and hind tibia without long setae as above ... (Society Islands) .....2
2. Wing with apical spot and/or band of infuscation on posterodistal portion; wing often falcate apically; mid femur without small strong black setae of varying shapes on apical third of ventral surface. *lobatus* group
- . Wing without apical spot or band of infuscation distally; mid femur with a short, strong black seta of varying shapes on apical third of ventral surface ..... *zigzag* group

### The *lobatus* group

**Diagnosis.** Species in the *Campsicnemus lobatus* group are easily distinguished by the spot of color at the apex of the radial portion of the wing (Figs. 5, 6, 8, 9) and/or the small spot at the apex of vein CuA<sub>1</sub> (Figs. 7–9). Species are usually dark in coloration with an almost all black head and thorax while the abdominal terg-

ites may be all dark brown to black or with some yellow patterning on the basal segments. The species in the *lobatus* group comprise some of the largest species in the genus (4–7 mm in length). This species group is restricted to the Society Islands in French Polynesia and all members are associated with wet, shady seeps. Water-skating *Campsicnemus* are present in the Marquesas and the Hawaiian Islands where gerrids are absent. Gerrids are present in the Society Islands and it is theorized here that the species in the *lobatus* group have evolved from the water surface-inhabiting species to shady seep-inhabiting species on the rock walls adjacent to these pools in order to avoid competition and/or predation from the gerrids in the pools below them.

Included species:

*borabora* Evenhuis, **n. sp.** (Society Islands [Bora Bora]).

*lobatus* Evenhuis, **n. sp.** (Society Islands [Moorea]).

*paralobatus* Evenhuis, **n. sp.** (Society Islands [Tahiti]).

*rheocrenus* Evenhuis, **n. sp.** (Society Islands [Tahiti]).

*tunoa* Evenhuis, **n. sp.** (Society Islands [Moorea]).

**Remarks.** A single female from Taha'a has been examined during this study and may represent an additional new species but until males from Taha'a are collected, its species identification cannot be ascertained.

### Key to species of the *Campsicnemus lobatus* group

(based on males)

1. Abdominal tergites II and III brown, without contrasting yellow color; distance between veins  $R_{2+3}$  and  $R_{4+5}$  at wing margin subequal to distance between veins  $R_{4+5}$  and  $M_{1+2}$  at wing margin; anal region of wing with distinct lobe (Figs. 5–6); spot of contrasting color at end of vein  $CuA_1$  not evident although band of infuscation present ..... 2  
 Abdominal tergites II and III with contrasting yellow color laterally; distance between veins  $R_{2+3}$  and  $R_{4+5}$  at wing margin about one-third that between veins  $R_{4+5}$  and  $M_{1+2}$  at wing margin; anal region of wing without distinct lobe; small spot of contrasting color present at end of vein  $CuA_1$  (Fig. 7–9) ..... 3
2. Apex of wing falcate below apical spot; distal margin between end of veins  $M_{1+2}$  and  $CuA_1$  with thick band of infuscation (Fig. 5) ... (Moorea) ..... *lobatus* Evenhuis, **n. sp.**
- Apex of wing not falcate below apical spot; infuscation on distal margin of wing, if present, very thin ... (Tahiti) ..... *rheocrenus* Evenhuis, **n. sp.**
3. Apex of wing without distinct spot of color at end of  $M_{1+2}$  (Fig. 7) ... (Bora Bora) .....  
 ..... *borabora* Evenhuis, **n. sp.**  
 Apex of wing distinct spot of color at end of  $M_{1+2}$  (Figs. 8–9) ..... 4
4. Crossvein dm-cu perpendicular to radial veins ... (Tahiti)..... *paralobatus* Evenhuis, **n. sp.**
- Crossvein dm-cu perpendicular to vein  $CuA_1$  ... (Moorea) ..... *tunoa* Evenhuis, **n. sp.**

### *Campsicnemus borabora* Evenhuis, **n. sp.**

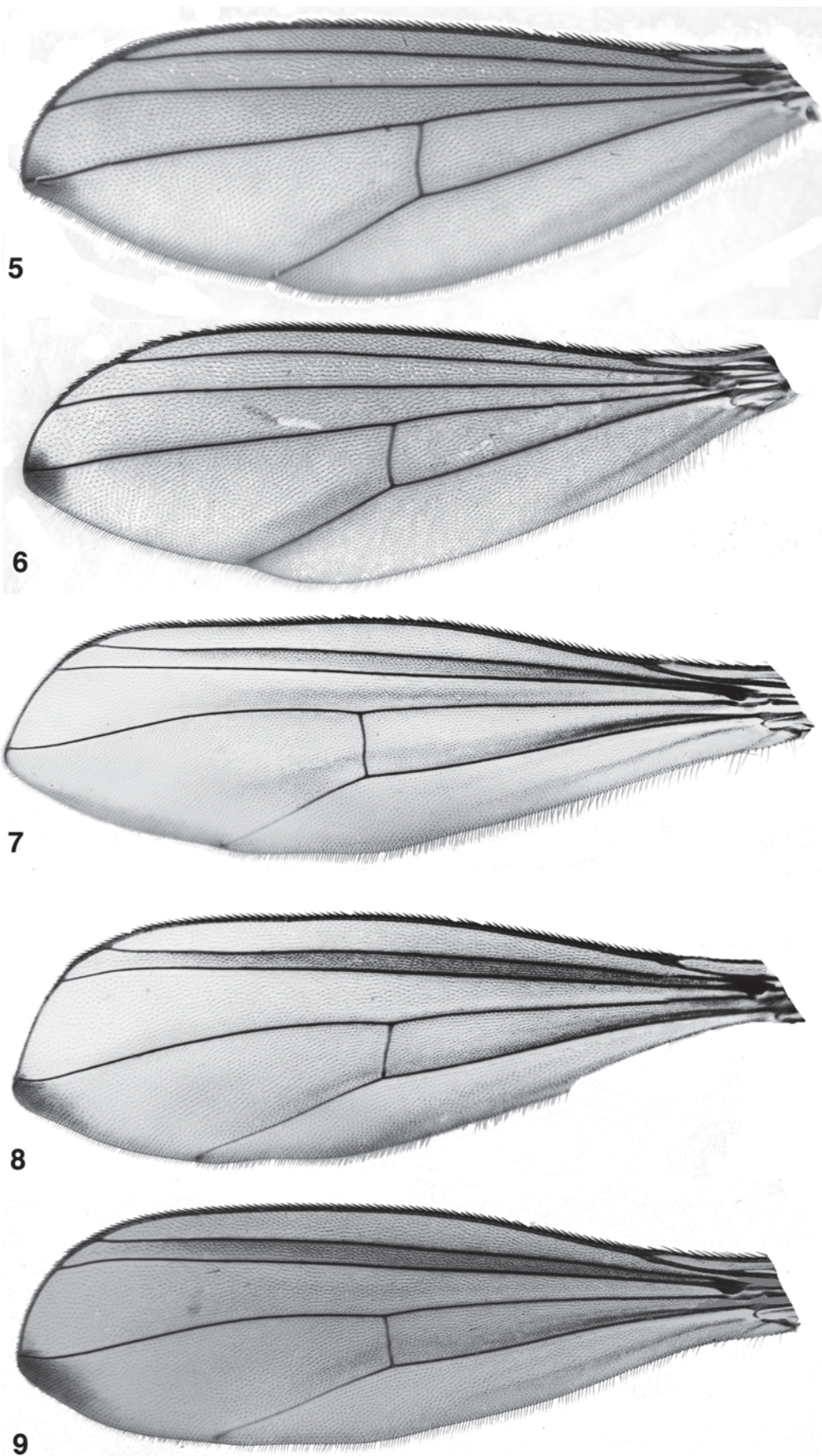
(Figs. 1, 7, 10)

**Diagnosis.** Among the *lobatus* group of *Campsicnemus*, this species is similar to *C. tunoa* and *C. paralobatus* in having yellow coloration on the lateral portions of tergites II and III. It can be separated from them by the lack of a distinct spot of color apically on the wing at the end of vein  $M_{1+2}$  (this spot present in *C. paralobatus* and *C. tunoa*).



**FIGURES 1–4.** *Campsicnemus lobatus* group, male habitus. 1. *C. borabora*; 2. *C. lobatus*; 3. *C. paralobatus*; 4. *C. tunoa*.





**FIGURES 5–9.** *Campsicnemus lobatus* group wings. **5.** *C. lobatus*; **6.** *C. rheocrenus*; **7.** *C. borabora*; **8.** *C. paralobatus*; **9.** *C. tunoa*.





**FIGURES 10–13.** Localities for species of the *lobatus* group. **10.** Lower Fa’anui stream, Bora Bora. Photo by Ron Englund. **11.** Afareiatu Cascade, Moorea. Photo by Patrick O’Grady. **12.** Small unnamed cascade below Cascade Vaimahuta, Tahiti (unofficially named Craig’s Cascade). Photo by Doug Craig. **13.** Seep at Col Urufau, Tahiti. Photo by Patrick O’Grady.



**Description.** Body length: 6.5–6.7 mm. Wing length: 4.2–6.0 mm. **Male.** *Head.* Black, face black with reddish bronze highlights; oc and vt black, about one-half length of antennal arista; front, occiput, and vertex black with blue highlights; face constricted at middle, almost holoptic, eyes separated below antennae by width of 3 ommatidia; palp very small, dark brown; proboscis very small, brown, extending slightly below eye in lateral view; antennal segments brown; postpedicel subtriangular, length subequal to width; arista about equal to head height.

*Thorax:* Mesoscutum, scutellum, and pleura dark brown to black throughout, with a few metallic greenish highlights laterally; thoracic setae black: 4 dc; 2 np; 2 ph; 1 pa; 1 + 1 sc; ac uniseriate; halter stem and knob white.

*Legs:* CI yellowish white, CII and CIII brown; FI and FII yellowish white, FIII yellowish basally, dark brown on apical one-half; TiI yellow, TiII and TiIII yellow only at extreme base, otherwise legs brown; femora without MSSC; TiII with 6–8 strong black setae basally, medially and apically on lateral and anterior surfaces, smaller stiff black setae and hairs along entire mesal surface (MSSC?); remainder of leg segments without MSSC.

*Wing* (Fig. 7): Pale smoky throughout; costal region bulging near midpoint; cell r2+3 infuscated basally (MSSC); R<sub>2+3</sub> and R<sub>4+5</sub> parallel almost to wing margin where they diverge very slightly; vein M<sub>1+2</sub> curved downward beyond crossvein dm-cu, curved slightly upward at wing margin; thick band of infuscation along distal wing margin from just below end of M<sub>1+2</sub> to end of CuA<sub>1</sub> (MSSC); small spot of black color at end of M<sub>1+2</sub> (MSSC); anal lobe reduced, without distinct lobe, edge slightly concave just posterior to end of vein M<sub>1+2</sub>.

*Abdomen.* Dark brown with short black hairs dorsally on each tergite, a few longer hairs laterally; tergites II and III with large yellow patches of color posterolaterally (MSSC) (Fig. 1); tergal interstices whitish; sternites II and III yellowish, sternites IV–VII brown. Hypopygium brown with brown cerci, not dissected.

**Female.** As in male except for lack of MSSC; face slightly bulging in lateral view; eyes more dichoptic, not converging below antennal bases.

**Types.** *Holotype* ♂ (BPBM 16,824) and 1 ♂ *paratype* from FRENCH POLYNESIA: **Society Is:** Bora Bora: Fa'anui Stream, 100–118 m, 1 Jul 2007, R.A. Englund, S. Jordan (see Fig. 10). *Other paratypes:* FRENCH POLYNESIA: **Society Is:** Bora Bora: 6 ♀, Fa'anui Stream, 81 m, 2 Jul 2007, R.A. Englund, S. Jordan. Holotype and paratypes in BPBM.

**Etymology.** The specific epithet derives from the type locality of the island of Bora Bora and is treated as a noun in apposition.

### ***Campsicnemus lobatus* Evenhuis, n. sp.**

(Figs. 2, 5, 11)

**Diagnosis.** Among species of the *lobatus* group, it is similar to *C. rheocrenus* but can be separated from it by the presence of a falcate wing tip (this shape not present in *C. rheocrenus*) and by the thick band of infuscation along the distal wing margin (this band of infuscation, if present, very thin in *C. rheocrenus*).

**Description.** Body length: 6.5–7.0 mm. Wing length: 5.5–6.2 mm. **Head.** **Male.** Black, face black; oc and vt black, about one-half length of antennal arista; front, occiput, and vertex black with blue highlights; face constricted at middle, eyes holoptic; palp very small, dark brown; proboscis very small, brown, not extending below eye in lateral view; antennal segments brown; postpedicel subtriangular, length about equal to width; arista slightly longer than head height.

*Thorax:* Mesoscutum, scutellum, and pleura dark brown to black throughout, with a few metallic greenish highlights laterally; thoracic setae black: 4 dc; 2 np; 2 ph; 1 pa; 1 + 1 sc; ac uniseriate; halter stem and knob white.

**Legs:** CI yellowish white, CII and CIII brown; FI and FII yellowish white, FIII yellowish basally, dark brown on apical one-half; TiI and TiII all yellow; TiIII yellow only at extreme base, otherwise legs brown; femora without MSSC; TiII with 6–8 strong black setae basally, medially and apically on lateral and anterior surfaces, smaller stiff black setae and hairs along entire mesal surface (MSSC?); remainder of leg segments without MSSC.

**Wing** (Fig. 5): Pale smoky throughout; costal region straight, not bulging; cell  $r_{2+3}$  not infuscated;  $R_{2+3}$  and  $R_{4+5}$  parallel at wing margin, about as wide as distance between  $R_{4+5}$  and  $M_{1+2}$  at wing margin; vein  $M_{1+2}$  straight to wing margin; apex of wing falcate just below end of vein  $M_{1+2}$ ; thick spot of color at apex of wing extending posteriorly as thick band of infuscation along distal and posterior wing margin from end of  $M_{1+2}$  (MSSC); vein  $CuA_1$  with thick infuscation from crossvein dm-cu to wing margin (MSSC); crossvein dm-cu perpendicular to radial veins; anal region with distinct lobe.

**Abdomen.** Dark brown with short black hairs dorsally on each tergite, a few longer hairs laterally; tergal interstices whitish; sternites yellowish brown. Hypopygium brown with paler brown cerci, not dissected.

**Female.** As in male except for lack of MSSC; eyes dichoptic, face bulging slightly in lateral view; legs normal, without modifications.

**Types.** *Holotype* ♂ (BPBM 16,647) [BPBM1013220] and 19♂ [BPBM1013221], 30♀ [BPBM1013222] *paratypes* from FRENCH POLYNESIA: **Society Is:** Moorea: Tohlea Trail, tributary to Putoa Riv., above captage, ~150 m, 18 Mar 2007, sweeping wet rocks on side of stream, R.A. Englund. *Other paratypes:* FRENCH POLYNESIA: **Society Is:** Moorea: 2♂ [EMEC1013026], 6♀ [EMEC1013027], 3 coconuts trail, 350 m, 17°32'58"S, 149°50'06"W, sweeping wet seeps adjacent to cascade at stream, 10 Jul 2006, P. O'Grady; 2♂ [BPBM1013223], 3♀ [BPBM1013224], Vaïoro Rivière waterfall above Afareaitu, sweeping seeps at small cascade and 30-foot waterfall near head of valley and main 150-foot waterfall, 11 Jul 2006, N. Evenhuis, P. O'Grady (see Fig. 11). *Holotype* in BPBM. *Paratypes* in BPBM, and EMEC.

**Etymology.** The specific epithet derives from the Latin *lobus* = “elongated projection”; referring to the characteristic small lobe-like or falcate apex of the wing.

### ***Campsicnemus paralobatus* Evenhuis, new species**

(Figs. 3, 8, 12)

**Diagnosis.** Similar to *C. borabora* and *C. tunoa* by virtue of the yellow color on the lateral portions of tergites II and III. It can be separated from *C. borabora* by the prominent apical spot of color on the wing (this spot absent in *C. borabora*) and distinguished from both species by the crossvein dm-cu perpendicular to the radial veins (this crossvein perpendicular to vein  $CuA_1$  in *C. borabora* and *C. tunoa*).

**Description.** Body length: 6.2 mm. Wing length: 5.7 mm. **Male.** *Head.* Black, face black; oc and vt black, about one-half length of antennal arista; front, occiput, and vertex black with blue highlights; face constricted at middle, eyes holoptic; palp very small, dark brown; proboscis very small, brown, extending slightly below eye in lateral view; antennal segments black to brown; postpedicel long, subtriangular, rounded apically, length about 3.5 x width; arista slightly longer than head height.

*Thorax:* Mesoscutum, scutellum, and pleura dark brown to black throughout, with a few metallic greenish highlights laterally; thoracic setae black: 4 dc; 2 np; 2 ph; 1 pa; 1 + 1 sc; ac uniseriate; halter stem and knob white.

*Legs:* CI and CIII white, otherwise as in *C. lobatus*.

**Wing** (Fig. 8): Pale smoky throughout; costal region bulging near midpoint; cell  $r_{2+3}$  infuscated along most of its length (MSSC);  $R_{2+3}$  and  $R_{4+5}$  parallel almost to wing margin where they diverge very slightly; vein  $M_{1+2}$  curved downward beyond crossvein dm-cu, curved slightly upward at wing margin; apex of wing slightly



falcate; end of vein  $M_{1+2}$  with thick spot of color, extending to relatively thin band of infuscation along distal wing margin from just below end of  $M_{1+2}$  to end of  $CuA_1$  (MSSC); small spot of black color at end of  $M_{1+2}$  (MSSC); crossvein dm-cu perpendicular to radial veins; anal lobe reduced, without distinct lobe, edge slightly concave just posterior to end of vein  $M_{1+2}$ .

**Abdomen.** Dark brown with short black hairs dorsally on each tergite, a few longer hairs laterally; tergites II and III with large yellow patches of color laterally (MSSC) (Fig. 3); tergal interstices whitish; sternites II and III yellowish, sternites IV–VII brown. Hypopygium brown with brown cerci, not dissected.

**Female.** Unknown.

**Types.** *Holotype* ♂ (BPBM 16,740) [BPBM101247] from FRENCH POLYNESIA: **Society Is:** TAHITI NUI: Cascades de Tefauromai, Cascade Vaimahuta, 31 Mar 2007, in small cascade 100 m below main falls, N.L. Evenhuis (see Fig. 12). Holotype in BPBM.

**Remarks.** The left wing was removed for photography and is placed in a microvial in association with the type specimen. Diligent collecting at the main steep wall of cascades (over 100 m tall) and surrounding seeps on this collecting trip and a subsequent one did not find any *Campsicnemus*. However, sweeping the seep of a small cascade originating from a tributary further downstream (the cascade was only a few meters tall) resulted in the collection of this single specimen.

**Etymology.** The specific epithet derives from the Latin *para*, “near” + *lobatus*; referring to close appearance of this species to *lobatus* from Moorea.

### ***Campsicnemus rheocrenus* Evenhuis, new species**

(Fig. 6, 13)

**Diagnosis.** Among species of the *lobatus* group, it is similar to *C. lobatus* but can be separated from it by the lack of a falcate wing tip (present in *C. lobatus*) and, if present, by the thin band of infuscation along the distal wing margin (this band of infuscation thick in *C. lobatus*).

**Description.** Body length: 5.8–6.5 mm. Wing length: 5.2–6.0 mm. **Male.** *Head.* Black, face black; oc and vt black, about one-third length of antennal arista; front, occiput, and vertex black with blue highlights; face constricted at middle, almost holoptic, eyes separated below antennae by width of 1–2 ommatidia; palp very small, dark brown; proboscis brown, extending slightly below eye in lateral view; antennal segments black to brown; postpedicel subtriangular, length subequal to width; arista about equal to head height.

*Thorax:* Mesoscutum, scutellum, and pleura dark brown to black throughout, with a few metallic greenish highlights laterally; thoracic setae black: 4 dc; 2 np; 2 ph; 1 pa; 1 + 1 sc; ac uniseriate; halter stem and knob white.

*Legs:* CI yellowish white, CII and CIII brown; FI and FII yellowish white, FIII yellowish basally, dark brown on apical one-half; TiI all yellow; TiII yellowish brown; TiIII yellow only at extreme base, otherwise legs brown; femora without MSSC; TiII with 6–8 strong black setae basally, medially and apically on lateral and anterior surfaces, smaller stiff black setae and hairs along entire mesal surface (MSSC?); remainder of leg segments without MSSC.

*Wing* (Fig. 6): Pale smoky throughout; costal region straight, not bulging; cell  $r_{2+3}$  not infuscated;  $R_{2+3}$  and  $R_{4+5}$  parallel at wing margin, about as wide as distance between  $R_{4+5}$  and  $M_{1+2}$  at wing margin; vein  $M_{1+2}$  straight to wing margin; apex of wing not falcate just below end of vein  $M_{1+2}$ ; thick spot of color at apex of wing separated from very indistinct, thin band of infuscation along distal wing margin from end of  $M_{1+2}$  to vein  $CuA_1$  (MSSC); vein  $CuA_1$  with thick infuscation from crossvein dm-cu to wing margin (MSSC); crossvein dm-cu perpendicular to radial veins; anal region with distinct lobe.

**Abdomen.** Dark brown to black with short black hairs dorsally on each tergite, a few longer hairs laterally;

tergal interstices whitish; sternites yellowish brown. Hypopygium brown with brown cerci, not dissected.

**Female.** As in male except for lack of MSSC.

**Types.** *Holotype* ♂ (BPBM 16,660) [BPBM101267], 23 ♂ [BPBM101268], and 7♀ BPBM101269 *paratypes* from FRENCH POLYNESIA: **Society Is:** TAHITI NUI: Punaruu River, 1–2 km E. Punaauia on way to Plateau Tamanu, 140–160 m, 20 Jul 2006, on seeps next to stream, N. Evenhuis, P. O’Grady. *Other paratypes:* FRENCH POLYNESIA: **Society Is:** TAHITI NUI: 4♂ [BPBM101270], 3 ♀ [BPBM101271], Col Urufaa, tunnel and seeps along road, 700 m, 16 Jul 2006, N. Evenhuis, P. O’Grady (see Fig. 13); 1♂ [BPBM101272], 1 ♀ [BPBM101273], same data except: 0.5 km S. Col Urufaa, 575 m; 3 ♂ [BPBM101274], 1 ♀ [BPBM101275], same data except: 2.5 km S. Lac Vaihiria, 350 m, sweeping cascades and dark wet boulders, P. O’Grady; 1♂ [BPBM101276], Cascades de Tefauromai, Vaipuu Rivière below Cascade Haamarere Rahi, on stream rocks, 31 Mar 2007, N. Evenhuis; 1♂ [BPBM101277], Papenoo Valley, Mar 1955, N.L.H. Krauss; 1♀ [BPBM101278], Papeete, Mar 1955, N.L.H. Krauss. TAHITI ITI: 2 ♂ [BPBM101279], 6♀ [BPBM101280], Rt. 33 on road to Taravao Plateau, on stream rocks above captage, 30 Mar 2007, R.A. Englund. Holotype in BPBM. Paratypes in BPBM, EMEC, and USNM. All except the Krauss specimens are preserved in ethanol.

**Remarks.** During initial collecting and sorting I had grouped this species and *C. lobatus* into the same “morphospecies”. However, close examination of the wing characters showed consistent differences in the markings and apical shape of the wing as well as mid tibial coloration differences that separate the two.

**Etymology.** The specific epithet derives from the Greek *ρηνεος* = “flowing” + *κρηνη* = “spring”; referring to the habitat of this species being found along seeps and wet rocks adjacent to streams

### ***Campsicnemus tunoa* Evenhuis, n. sp.**

(Figs. 4, 9)

**Diagnosis.** Among species of the *lobatus* group with an apical spot and reduced anal lobe, it is most similar to *C. paralobatus* but can be separated from it by the crossvein dm-cu perpendicular to vein CuA<sub>1</sub> (this crossvein perpendicular to the radial veins in *C. paralobatus*).

**Description.** Body length: 6.5 mm. Wing length: 6.0 mm. **Male.** *Head.* Black, face dark brown to black with reddish highlights, paler brown near clypeus; oc and vt black, about two-thirds length of antennal arista; front, occiput, and vertex black with blue highlights; face constricted at middle, almost holoptic, eyes separated below antennae by width of 1–2 ommatidia; palp very small, dark brown; proboscis very small, brown, not extending below eye in lateral view; antennal segments black to brown; postpedicel long, subtriangular, length about equal to width; arista subequal to head height.

*Thorax:* Mesoscutum, scutellum, and pleura (except yellow metepisternum) dark brown to black throughout, with a few metallic greenish highlights laterally; thoracic setae black: 4 dc; 2 np; 2 ph; 1 pa; 1 + 1 sc; ac uniseriate; halter stem and knob white.

*Legs:* CI and CIII yellowish white, CII; FI and FII yellowish white, FIII yellowish basally, dark brown on apical one-half; TiI all yellow; TiII yellowish brown basally, brown on apical two-thirds; TiIII yellow only at extreme base, otherwise legs brown; femora without MSSC; TiII with 6–8 strong black setae basally, medially and apically on lateral and anterior surfaces, smaller stiff black setae and hairs along entire mesal surface (MSSC?); remainder of leg segments without MSSC.

*Wing* (Fig. 9): Pale smoky throughout; costal region bulging near midpoint; cell r2+3 infuscated along most of its length (MSSC); R<sub>2+3</sub> and R<sub>4+5</sub> parallel almost to wing margin where they diverge very slightly; vein M<sub>1+2</sub> curved downward beyond crossvein dm-cu, curved slightly upward at wing margin; apex of wing slightly falcate; end of vein M<sub>1+2</sub> with thick spot of color, extending to relatively thin band of infuscation along distal wing margin from just below end of M<sub>1+2</sub> to end of CuA<sub>1</sub> (MSSC); small spot of black color at end of M<sub>1+2</sub>

(MSSC); crossvein dm-cu perpendicular to vein CuA<sub>1</sub>; anal lobe reduced, without distinct lobe, edge slightly concave just posterior to end of vein M<sub>1+2</sub>.

**Abdomen.** Dark brown with short black hairs dorsally on each tergite, a few longer hairs laterally; tergites II and III with large yellow patches of color laterally and extending onto dorsum (MSSC) (Fig. 4); tergal interstices whitish; sternites II–IV yellowish, sternites I, V–VII brown. Hypopygium brown with brown cerci, not dissected.

**Female.** Unknown.

**Types.** *Holotype* ♂ (BPBM 16,987) [BPBM1013220] from FRENCH POLYNESIA: **Society Is:** Moorea: Tohiea Trail, tributary to Putoa Riv., above captage, ~150 m, 18 Mar 2007, sweeping wet rocks on side of stream, R.A. Englund. *Holotype* in BPBM.

**Remarks.** Left wing removed for photography and placed in a microvial in association with the type.

**Etymology.** The specific epithet derives from the Tahitian *tunoa* = “beauty spot”; referring to the apical spot on the wing.

## The zigzag group

**Diagnosis.** Species in the *zigzag* group are easily distinguished by the distinctive thick, modified seta on the ventroapical third of the mid femur (Figs. 14–18). No other species of *Campsicnemus* known have this ventral femoral setal modification. Species in this group are some of the smallest in the genus (from 1.0–2.3 mm in length).

**Remarks.** The species in this group are endemic to the Society Islands and, except for two species that are both found on Tahiti (*C. ogradyi*, n. sp. and *C. zigzag*, n. sp.), there appears to be one species per island. If the one-island-one-species formula hold true for the remainder of the Society Islands, further collecting should reveal species of this group on Moorea and Bora Bora.

Although some species were collected in association with rocks in or near streams, they are also found in sweeps of vegetation and are probably more associated with the riparian areas of streams rather than the close association with wet seeps of members of the *lobatus* group from the Society Islands or actual water skaters of the members of the *Campsicnemus* described from the Marquesas.

### Included species:

*mylloseta* Evenhuis, **n. sp.** (Society Islands [Huahine]).

*ogradyi* Evenhuis, **n. sp.** (Society Islands [Tahiti]).

*ostlinx* Evenhuis, **n. sp.** (Society Islands [Raiatea]).

*tahaanus* Evenhuis, **n. sp.** (Society Islands [Tahaa]).

*zigzag* Evenhuis, **n. sp.** (Society Islands [Tahiti]).

## Key to species in the zigzag group

1. Mid femur with curlicue shaped thick black setae ventrally (Fig. 16); mid tibia straight, with small patch of peg-like setae just basal to midpoint on mesal surface (Fig. 21) ... (Raiatea) ..... *ostlinx* Evenhuis, **n. sp.**
- . Mid femur with thick black ventral seta not curlicue-shaped, shaped otherwise; mid tibia without peg-like setae near middle ..... 2
2. Mid femur with hook shaped thick black setae ventrally (Fig. 15); mid tibia conspicuously bowed on basal half, all black (Fig. 20) ... (Tahiti) ..... *ogradyi* Evenhuis, **n. sp.**
- . Mid femur with thick black ventral seta not hook-shaped, shaped otherwise; mid tibia not all black, not bowed on basal half ..... 3



3. Mid femur with kinked thick black setae ventrally (Fig. 14); mid tibia with slight swelling just basal to midpoint, with dark sclerotization and 6–7 strong stiff black setae (Fig. 19) ... (Huahine) ..... *mylloseta* Evenhuis, **n. sp.**
- . Mid femur with thick black ventral seta not kinked, shaped otherwise; mid tibia with stiff black setae not restricted to medial swollen area .....4
4. Mid femur with bifid thick black setae ventrally (Fig. 17); mid tibia relatively straight, bearing numerous stiff, spine like setae uniformly distributed, long, strong black setae only apically (Fig. 22) ... (Tahaa)..... *tahaanus* Evenhuis, **n. sp.**
- . Mid femur with zigzagged thick black setae ventrally (Fig. 14; mid tibia slightly bowed, darkly sclerotized on mesal lateral surface, mesal surface with row of strong stiff black spines on mesal surface (Fig. 23) ... (Tahiti)..... *zigzag* Evenhuis, **n. sp.**

### ***Campsicnemus mylloseta* Evenhuis, new species**

(Figs. 14, 19)

**Diagnosis.** This species is easily distinguished from the other members of this species group by the single kinked seta with a tiny horn-like spur (Fig. 14) on the apical third of the male mid femur venter (this modified setae hooked, curlicue, bifid, or bent in the other species).

**Description.** Body length: 1.0–1.1 mm. Wing length: 1.3–1.4 mm. **Male.** *Head.* Black, face black; oc and vt broken off; front, occiput, and vertex black with blue highlights; face constricted at middle, almost holoptic, eyes separated below antennae by width of 1–2 ommatidia; palp small, dark brown; proboscis brown, extending slightly below eye in lateral view; antennal segments yellowish brown; postpedicel long, conical, length about 3.5 x width; arista slightly longer than head height.

*Thorax:* Mesoscutum, scutellum, and pleura yellowish with brown admedian vittae coalesced in prescutellar area; thoracic setae black: 1 + 3 dc; 2 np; 2 ph; 1 pa; 1 + 1 sc; ac absent; halter stem yellowish brown, knob brown.

*Legs:* CI and CIII; CII brown; remainder of legs yellowish; FII (Fig. 14) with 4–5 stiff black setae ventrally, with one thick straight seta and one crooked or kinked seta with small horn-like spur; TiII (Fig. 19) relatively straight, swollen medially, with 8 long stiff setae on lateral surface basal to and on swollen area (MSSC), smaller black setae and hairs along entire ventral and posterior surfaces. Remainder of leg segments broken off and missing.

*Wing:* Pale smoky throughout; subcostal section straight, not concave; alula extremely reduced; no indentation on  $M_{1+2}$  beyond crossvein dm-cu; crossvein dm-cu perpendicular to  $CuA_1$ .

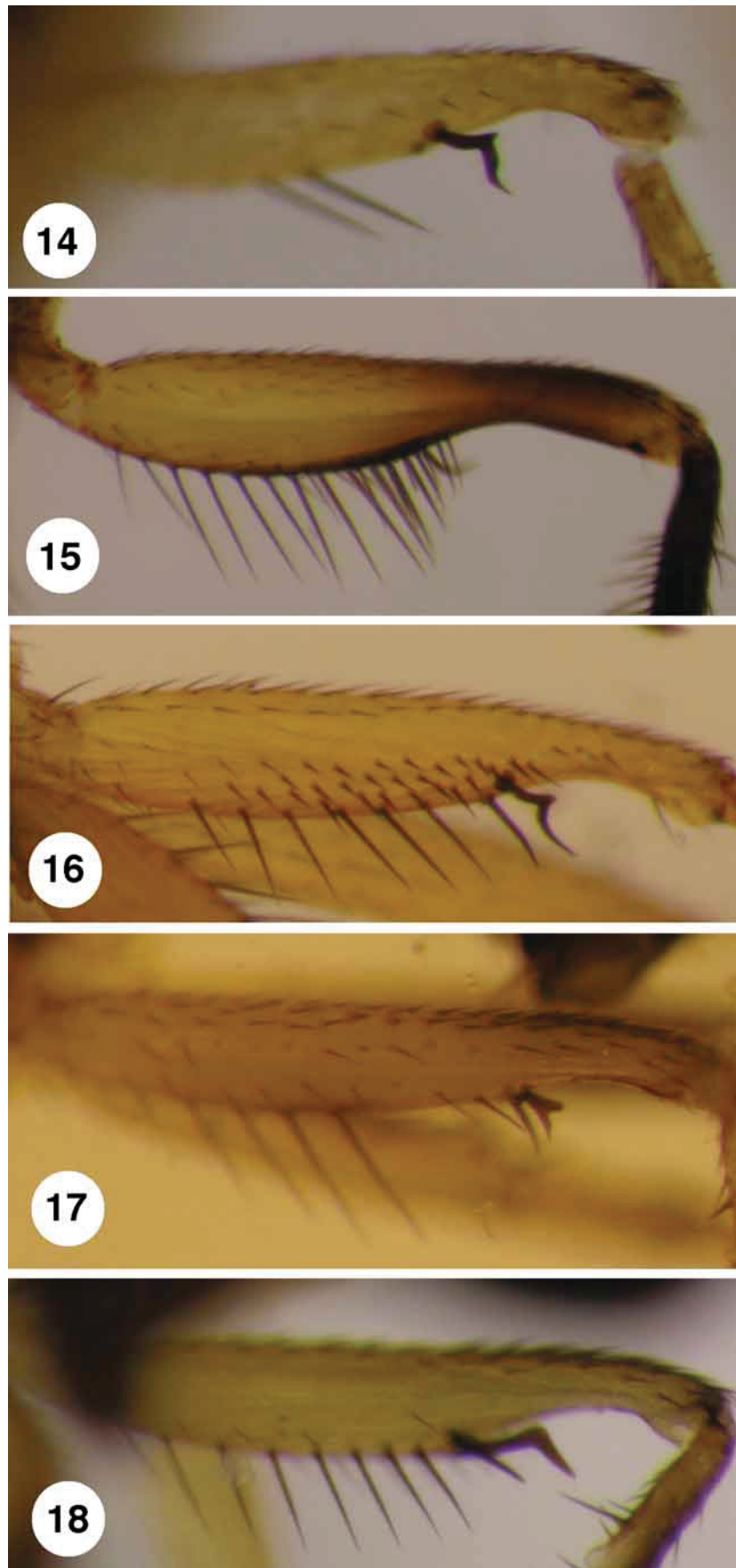
*Abdomen.* Yellow with brown along posterior margins, with sparse short black hairs dorsally on each tergite; tergal interstices whitish; sternites yellowish. Hypopygium yellowish brown with paler brown cerci, not dissected.

**Female.** same as in male except lack of MSSC; postpedicel length subequal to width, pointed apically.

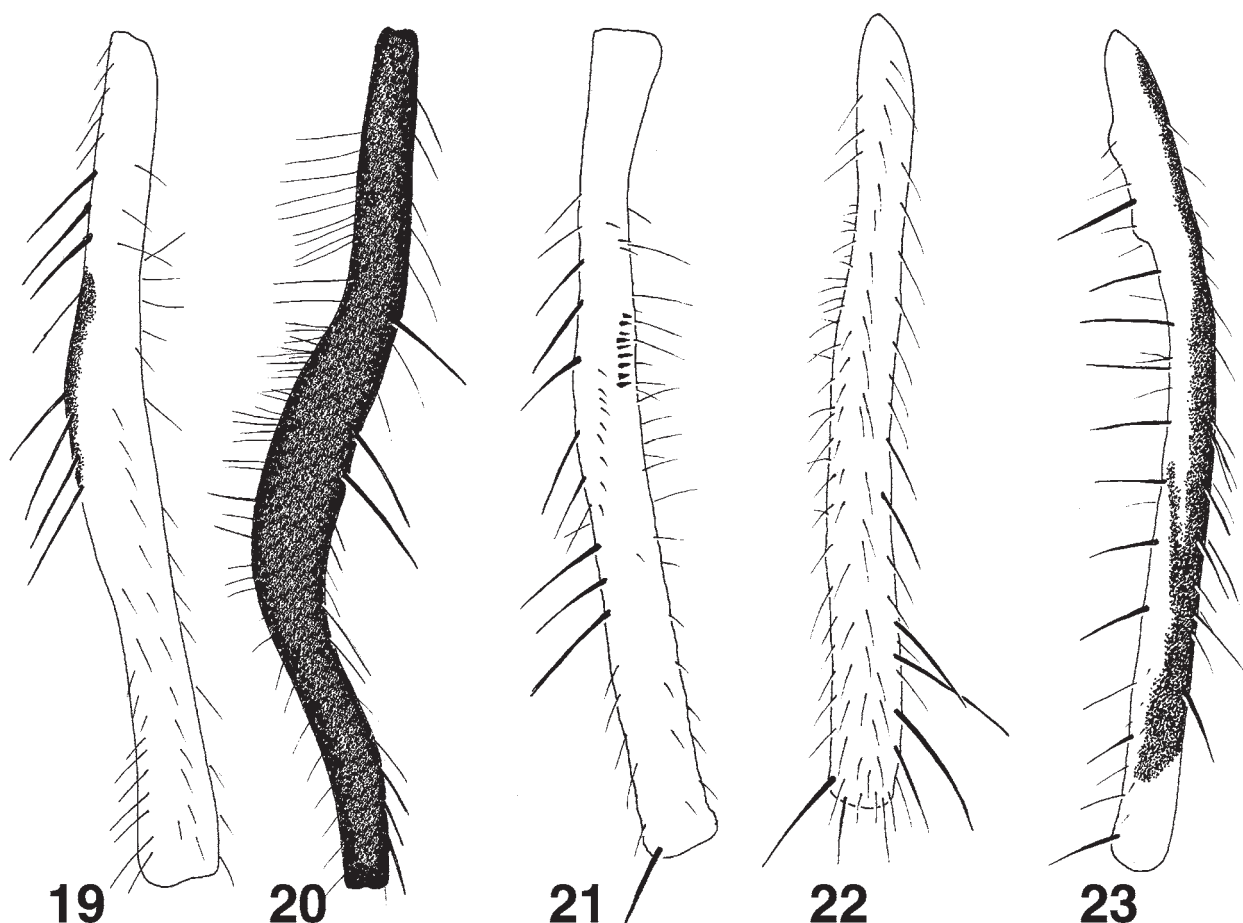
**Types.** *Holotype* ♂ (BPBM 16,749) and paratype ♀ from FRENCH POLYNESIA: **Society Is:** HUAHINE: Mt. Turi, 630–650 m, 25 Jul 2007, *Metrosideros* sweep, R. Englund. Holotype deposited in BPBM.

**Remarks.** The holotype is damaged with only the mid femora (and one mid tibia) remaining beyond the coxae. The rest of the legs are missing but enough salient characters exist to easily verify this as a new species. Given these facts plus the small chance that other specimens will be collected anytime soon as the type locality is extremely difficult to access, it was thought best to go ahead with the description here based on only one male specimen.

**Etymology.** The specific epithet derives from the Greek,  $\mu\psi\lambda\lambda\omicron\sigma$  = “bent, crooked”; referring to the kinked black seta on the venter of the mid femur that characterizes the species.



**FIGURES 14–18.** *Campsicnemus zigzag* group male mid femur. **14.** *C. mylloseta*; **15.** *C. ogradyi*; **16.** *C. ostlinx*; **17.** *C. tahaanus*; **18.** *C. zigzag*.



FIGURES 19–23. *Campsicnemus zigzag* group male mid tibia. 19. *C. mylloseta*; 20. *C. ogradyi*; 21. *C. ostlinx*; 22. *C. tahaanus*; 23. *C. zigzag*.

***Campsicnemus ogradyi* Evenhuis, new species**

(Figs. 15, 20)

**Diagnosis.** This species is easily distinguished from the other members of this species group by the single hooked or curved seta (Fig. 15) on the ventral third of the male mid femur (this modified setae curlicue, bifid, or zigzagged in the other species).

**Description.** Body length: 1.4–1.7 mm. Wing length: 1.8–2.0 mm. **Male.** *Head.* Black, face black, paler brown near clypeus; oc and vt black, about one-third length of antennal arista; front, occiput, and vertex black with blue highlights; face constricted at middle, almost holoptic, eyes separated below antennae by width of 2–4 ommatidia; palp very small, dark brown; proboscis very small, brown, not extending below eye in lateral view; antennal segments dark brown; postpedicel subtriangular, length about equal to width; arista slightly longer than head height.

*Thorax:* Mesoscutum, scutellum, and pleura dark brown to black throughout, with a few metallic reddish highlights posteriorly; thoracic setae black: 1 + 4 dc; 2 np; 2 ph; 1 pa; 1 + 1 sc; ac uniseriate; halter stem and knob white.

*Legs:* CI and CII brown; CIII yellowish brown; fore leg all brown; FII and FIII yellow on basal half, brown on apical half; TiII black, rest of legs dark brown; fore and hind legs without MSSC; FII (Fig. 15) swollen on basal 2/3, attenuate on apical 1/3, with 12–14 strong setae lateroventrally, 6 smaller setae on mesoventrally surface, thick hooked seta on apical third of ventral surface; TiII (Fig. 20) conspicuously bowed on



apical 3/5, with long setae in middle on dorsal surface (MSSC), smaller black setae and hairs along entire ventral surface. Remainder of leg segments without MSSC.

*Wing*: Pale smoky throughout; subcostal section straight, not concave; alula extremely reduced; no indentation on  $M_{1+2}$  beyond crossvein dm-cu; crossvein dm-cu perpendicular to  $CuA_1$ .

*Abdomen*. Dark brown with short black hairs dorsally on each tergite, a few longer hairs laterally; sternites dark brown. Hypopygium dark brown cerci, not dissected.

**Female**. Unknown.

**Types**. *Holotype* ♂ (BPBM 16,654) [BPBM101243] and *paratype* ♂ [BPBM101244] from FRENCH POLYNESIA: **Society Is**: TAHITI NUI: Vaituoru River, below Marato Hotel, 16 Jul 2006, sweeping rocks in river, P. O'Grady.

**Etymology**. This species is named for Patrick O'Grady, who collected this species, as well as a number of other new *Campsicnemus* species on Tahiti and Moorea during a collecting trip with me in July 2006. His decision to walk down the long, steep hill to collect at the stream at the bottom of the valley below the Marato Hotel (and my decision to stay at the hotel and not walk down) was his gain and my loss!

### *Campsicnemus ostlinx* Evenhuis, new species (Figs. 16, 21)

**Diagnosis**. Easily separated from the other species in the *zigzag* group by the curlicue setae (Fig. 16) on the venter of the mid femur in the male and the mid tibia bearing a patch of small, peg-like setae near the midpoint on the mesal surface (these peg-like setae absent in other species of the *zigzag* group).

**Description**. Body length: 2.2–2.3 mm. Wing length: 2.0–2.1 mm. **Male**. *Head*. Black, face black, silvery tomentose on clypeus; oc and vt black, about one-half length of antennal arista; front, occiput, and vertex black with blue highlights; face constricted at middle, almost holoptic, eyes separated below antennae by width of 1–2 ommatidia; palp small, brown; proboscis brown, extending well below eye in lateral view; antennal scape and pedicel black to brown; postpedicel black, long, lanceolate, length about 3.5 x width; arista slightly longer than head height.

*Thorax*: Mesoscutum, scutellum, and pleura dark brown to black throughout, with a few metallic greenish highlights laterally; thoracic setae black: 1 + 3 dc; 2 np; 2 ph; 1 pa; 1 sc; ac uniseriate; halter stem and knob white.

*Legs*: Coxae brown; femora yellow, FIII brown apically; rest of legs yellowish brown; FII (Fig. 16) with 6 stiff black setae ventrally, with one thick straight seta and one curlicue seta on apical third of ventral surface (MSSC); TiII (Fig. 21) relatively straight, with small patch of 8–9 peg-like setae basomedially and 3 strong black setae on apical one-third (MSSC), smaller black setae and hairs along entire ventral and posterior surfaces. Remainder of leg segments without MSSC.

*Wing*: Pale smoky throughout; subcostal section straight, not concave; alula extremely reduced; no indentation on  $M_{1+2}$  beyond crossvein dm-cu; crossvein dm-cu perpendicular to  $CuA_1$ .

*Abdomen*. Brown with short black hairs dorsally on each tergite, a few longer hairs laterally; tergal interstices whitish; sternites brown. Hypopygium brown with paler brown cerci, not dissected.

**Female**. Same as in male except lack of MSSC; postpedicel subtriangular, length subequal to height.

**Types**. *Holotype* ♂ (BPBM 16,631) [BPBM101245] and 1 ♀ *paratype* [BPBM101246] from FRENCH POLYNESIA: **Society Is**: RAIATEA: Temehani, Uteute, 1942 ft, 16.7792°S, 151.46326°W, 3 Feb 2006, R.A. Englund. Holotype and paratype in BPBM.

**Etymology**. The specific epithet derives from the Greek *οστλινξ* = “curled hair, tendril”; referring to the characteristic curlicue seta on the venter of the mid femur of the male.

***Campsicnemus tahaanus* Evenhuis, new species**  
(Figs. 17, 22)

**Diagnosis.** This species is easily distinguished from the other members of the *zigzag* group by the single bifid seta (Fig. 17) on the ventroapical third of the male mid femur (this modified seta hooked, curlicue, kinked, or zigzagged in the other species of this group).

**Description. Male.** Body length: 1.5 mm. Wing length: 1.4 mm. *Head* (damaged: the eyes, face, front and antennae are missing). Occiput and vertex black with blue highlights; palp small, dark brown; proboscis brown, extending below level of eye in lateral view.

*Thorax:* Mesoscutum (cracked medially and slightly damaged with some setae missing but setal sockets visible to allow for setal counts), scutellum, and pleura dark brown to black throughout, with a few metallic greenish highlights laterally; thoracic setae black: 1 + 3 dc; 2 np; 2 ph; 1 pa; 1 + 1 sc; ac absent; halter stem and knob brown.

*Legs:* CI and FI white; CII and CIII brown; FII yellowish brown, FIII yellowish brown basally, becoming darker brown on apical one-eighth; remainder of legs yellowish brown; FI and remainder of foreleg unmodified, without MSSC; FII (Fig. 17) with 5 stiff setae ventrally, single thick straight seta and single bifid seta on apical third of ventral surface; TiII (Fig. 22) relatively straight, with long setae restricted to apical one-fourth (MSSC), smaller black setae and hairs along entire ventral surface. Remainder of leg segments without MSSC.

*Wing:* Pale smoky throughout; subcostal section straight, not concave; alula extremely reduced; no indentation on  $M_{1+2}$  beyond crossvein dm-cu; crossvein dm-cu perpendicular to  $CuA_1$ .

*Abdomen.* Brown with short black hairs dorsally on each tergite, a few longer hairs laterally; tergal interstices whitish; sternites brown. Hypopygium brown with paler brown cerci, not dissected.

**Female.** Unknown.

**Types.** *Holotype* ♂ (BPBM 16,654) [BPBM101302] from FRENCH POLYNESIA: **Society Is:** TAHAA: Vaihururu Stream, 350 ft, 16.61365°S, 151.48914°W, riffles/pools, 21 Jun 2007, R. Englund, L. Englund.

**Etymology.** The species epithet derives from the type locality of the island of Tahaa.

***Campsicnemus zigzag* Evenhuis, new species**  
(Figs. 18, 23)

**Diagnosis.** Easily separated from the other members of the *zigzag* group by the characteristic zigzag-shaped setae on the ventral surface of the mid femur (Fig. 18) in males (this setae hooked, curlicue, or kinked in the other species of the *zigzag* group) and the mid tibia slightly bowed with dark sclerotization on the lateral surface and row of strong stiff black setae on the mesal surface (mid tibia shaped not with these characters in the other species in the *zigzag* group).

**Description.** Body length: 1.3–1.5 mm. Wing length: 1.2–1.6 mm. **Male. Head.** Black, face black; oc and vt black, about one-third length of antennal arista; front, occiput, and vertex black with blue highlights; face constricted at middle, almost holoptic, eyes separated below antennae by width of 1–2 ommatidia; palp small, dark brown; proboscis brown, extending slightly below eye in lateral view; antennal segments brown; postpedicel conical, length about 2 x width; arista slightly longer than head height.

*Thorax:* Mesoscutum and scutellum brown dorsally, with a few metallic greenish highlights laterally; pleura all yellow except dark brown metepimeron; thoracic setae black: 1 + 3 dc; 2 np; 2 ph; 1 pa; 1 + 1 sc; ac absent; halter stem and knob yellowish brown.

*Legs:* CI white; CII brown; CIII yellow; FI and FII all yellow; FIII yellow with brown on apical one-fourth; rest of legs yellowish brown; FII (Fig. 18) with 8–9 stiff black setae ventrally, with one thick black

straight seta and one thick black zigzagged seta on apical third of ventral surface (MSSC); TiII (Fig. 23) slightly bowed with dark sclerotization on lateral surface, with row of 9–10 strong black setae along mesal surface setae basomedially and 3 strong black setae on apical one-third (MSSC), smaller black setae and hairs along entire ventral and posterior surfaces. Remainder of leg segments without MSSC.

*Wing*: Pale smoky throughout; subcostal section straight, not concave; alula extremely reduced; no indentation on  $M_{1+2}$  beyond crossvein dm-cu; crossvein dm-cu perpendicular to  $M_{1+2}$ .

*Abdomen*. Brown with short black hairs dorsally on each tergite, a few longer hairs laterally; tergal interstices whitish; sternites brown. Hypopygium brown with brown cerci, not dissected.

**Female**. As in male except for lack of MSSC; postpedicel length subequal to width; legs normal, without modifications.

**Types**. *Holotype* ♂ (BPBM 16,640) [BPBM101326] and 2♂ [BPBM101327], 2♀ [BPBM101328] *paratypes* from FRENCH POLYNESIA: **Society Is**: TAHITI NUI: Mt. Mauru, Faatautia, 730 m, 17°37'45"S, 149°21'10"W, riparian habitat above and below lava tube, 19 Jul 2006, N. Evenhuis, P. O'Grady. *Other paratypes*: FRENCH POLYNESIA: **Society Is**: TAHITI NUI: 1 ♂ [BPBM101329], 2 ♀ [BPBM101330], Mt. Mauru, Faatautia, stream at hydro-electric structure, 720 m, 17°37'39"S, 149°31'26"W, sweeping wet rocks and seeps, 19 Jul 2006, N. Evenhuis, P. O'Grady. Holotype in BPBM. Paratypes in BPBM and EMEC.

**Non-type material**: FRENCH POLYNESIA: **Society Is**: TAHITI ITI: 3♂ [BPBM101331] (damaged), 3.5 km SE of Tautira, sweeping wet sand and coral rubble along beach, 18 Jul 2006, N. Evenhuis, P. O'Grady.

**Remarks**. The finding of 3 specimens of this species at the Tahiti Iti beach locality was surprising as the other specimens are all associated with higher elevation freshwater riparian habitats. But also collected at this beach in our coral rubble sweeps were specimens of an as yet undetermined *Simulium*. The latter specimens have been sent to Doug Craig in hopes he can identify them as he said he never expected that there would be beach simuliids in Tahiti (we found other beach simuliids at other localities so this collection is not an anomaly).

**Etymology**. The specific epithet derives from the French *zigzag* = “forked lightning”; referring to the characteristic stiff, zigzag-shaped, black seta on the ventral surface of the male mid femur.

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